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**ON THE POSSIBILITIES OF PROSPECTING
FOR ORES IN SIERRA LEONE**

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On the possibilities of prospecting for ores in Sierra Leone

by

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A. 5.2.1.

1. Geological aspects

Modern prospecting and exploration of ores requires as accurate a knowledge of the geology of the area to be prospected as possible. Therefore it is important to begin by discussing the stage of the geological survey of the country.

The necessary geological work, as well as the particular data required for the ore prospecting, on the other hand, must depend upon the general geology of the country.

The geological basement of Sierra Leone is Precambrian. Thus it belongs to the oldest formations of the globe. In this sense it has very much in common with similar Precambrian basements of, for instance, Canada and Finland. In such an environment, particular ore types are to be expected, and a geological mapping on a petrological basis is much more important than a stratigraphical differentiation of formations, as was the case when some older geological maps were made.

In Sierra Leone, there are several "schist belts" and areas which may be promising from the point of view of ore prospecting. Those in the Central part of the country have already been mapped in such way that the petrological requirements set forth above are fulfilled and there the geological survey necessary for the ore

1) Wilson, N.W.--Marmo, V., Geology, geomorphology and mineral resources of the Sula Mountains; Geol. Surv. Sierra Leone, Bull. n:o 1, Sierra Leone (1958).

Marmo, V., Geology of the Kangari Hills and of the area W of Mamansu: -Geol. Surv. Sierra Leone, Bull. n:o 2, (1962).

prospecting already exists. The major part of the country, however, still awaits this kind of survey, with the exception of the so called "Colony complex" on the Atlantic shore and the Gola forest on the Liberian frontier, which to the knowledge of the present author have been mapped, and results will be issued in the near future.

An important step in the future prospecting for ores is, however, a rapid continuation of the geological mapping of the country.

Geologically, Sierra Leone has many features, which may be promising from the point of view of ore prospecting. So far apart from diamonds and gold, mainly iron ores are known, one of which - at Marampa - is mined. Furthermore, in the hills of the central part of the country large deposits of banded ironstone occur. At Hangha, chromite has been mined. Actual sulphide ores, however, are still undiscovered. The presence of minor sulphide mineralizations is known there, and they promise the possibility of finding economical sulphide ores as well, including molybdenite which occurs there even more than in traces.

In my opinion, the schist belts of the country, as well as the alkaline rocks in different parts of the country are those which should be prospected. The former are geologically similar to those of other Precambrian countries where they often associate ore deposits, as well.

2. Applicability of modern exploration methods

The geological reconnaissance work as well as more detailed mapping so far carried out in the country, indicate that the ordinary "old fashioned" prospecting with hammers can hardly uncover any significant ores. Therefore, aside from geological mapping, more modern exploration methods are to be used.

Keeping in mind how limited the geological survey of the country is at present, the first step in prospecting should be one which covers the whole country quickly. The airborne geophysical survey is just such a method.

It can be done in a relatively short time providing dependable topo maps or air photographs exist. Usually such a survey is done using only magnetometers. If, keeping in mind the magnetic iron ores only, the method is effective, it will indicate all ore

bodies of significant size. It does not help, however, in the finding of sulphide ores - particularly so, because pyrrhotite, which often accompanies valuable sulphide ores, is in Sierra Leone sparse, or even rare.

For this purpose airborne electromagnetic survey is of importance, and it certainly will point out all areas which are really promising for sulphide ores, even if direct discovery of such ores by the air borne survey only is very unlikely. This should be anyhow the beginning of regional prospecting in such a country like Sierra Leone.

The method is expensive, but it saves very much time and also excludes large areas as unpromising. Therefore it will be finally the cheapest way to approach and even solve the actual problems. In addition it will also give much information which will facilitate and ensure the geological mapping as well, because geophysical results usually indicate important rock boundaries and tectonic features.

As mentioned above, the airborne work will indicate only the most promising areas, which need further geophysical survey on the surface. In Finland and Scandinavia, the prospecting of sulphide ores is mainly based on geophysics. Undoubtedly this must also be the case as far as the circumstances of Sierra Leone are concerned, and there especially electromagnetic methods must then be used and developed.

To my knowledge, such methods have never been used in Sierra Leone. It is true that there are certain features possibly hampering the use of these methods, such as the wide-spread lateritization. On the other hand, the oxides being the main constituents of the laterite, and the duricrust in the mountains being often comparatively thin, I would not think that this would hamper too much the use of, say, loop frame methods.

From my personal knowledge of the geology of Sierra Leone, within the mountains, there should not occur any electromagnetic anomalies other than mineralized zones and areas.

As previously mentioned, however, the best results with electromagnetic methods on the surface will be obtained only if they are used on areas found by air borne survey, because otherwise the places for such a survey are to be found haphazardly excepting a few areas already indicated by the presence of known minor sulphide mineralizations.

Furthermore, the major part of the western half of the country, which is covered by younger sediments, is probably unsuitable for such prospecting due to the thickness of the sediments.

Geochemical methods may also be of use, but from my own experience, only as subsidiary means fulfilling the interpretation of results obtained by geophysical methods.

3. The organization of the geophysical survey

The general program for ore prospecting in Sierra Leone, as outlined above, includes a certain amount of enlargement and re-organization of the existing survey. Despite the possible cost of such a work, it is still, in my opinion, the only way to direct prospecting, especially for sulphide ores, which may give dependable results in a reasonable time.

One of the most important points is that the geophysical prospecting should be carried out in the closest possible collaboration with geologists, and the interpretation of the results must be made strictly considering the geological data available.

For the largest program- the airborne geophysical survey - no local organization can be used, because considering the size of the country, the expenses of surveyors from abroad are still very much below those involved in the establishment of a local organization. It must be held in mind, however, that here the electromagnetic survey is of very much greater importance than solely magnetic, and therefore both are to be carried out simultaneously.

For the geophysical work on the surface, the establishment of a local organization as well as the local purchasing of instruments and equipment is urgently necessary. In actual fact, this should be done sufficiently early to enable the checking of airborne anomalies geophysically along the surface. For this purpose the purchasing of necessary equipments is less difficult, even if the loop-frame equipments have but few commercial producers. A very much more difficult problem is concerned with the recruitment of able personnel.

Because Sierra Leone itself is geologically a Precambrian country, it is of importance also that equipment purchased is suitable for such areas, and also that the people using the instruments, and in particular, those making the interpretations

of the anomalies must be trained in Precambrian areas.

The operators as well as field assistants of such geophysical prospecting can certainly be local people trained in the beginning abroad, later on locally. The actual geophysical staff, including technicians, on the contrary, can not be obtained from Sierra Leone, but for a long time imported well trained officers must probably be used. In the writer's opinion, it is of very great importance, that, at least in the beginning, there should be in charge of superficial geophysical prospecting, a man who is not only qualified geophysicist, but also sufficiently acquainted with Precambrian geology and trained in the interpretation of geophysical anomalies with particular reference to Precambrian circumstances. This is important in order to avoid unnecessary detailed work. In addition, a technician familiar with such instruments and capable of making simple reparations is needed, because his presence on the staff can save much time and avoids sending the instruments abroad for simple reparations. His training also must take place abroad.

Thus the further development of activities for prospecting for ores in Sierra Leone needs a regional airborne geophysical survey carried out by foreign organizations. The anomalies obtained must be investigated using geophysical and geological surveys on the surface and by a local organization which should be established sufficiently early using mainly imported professional staff.

